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ABSTRACT

This speech reports an experiment on memory and verbal ability. The study notes that in previous research, verbal ability has been found to correlate with sensitivity to order, an important component of intelligence. This relationship may be due largely to the greater word store of high verbal scorers. The author's experimental hypothesis is that clustering scores will not differentiate high and low verbal ability subjects, if one omits items retrieved from the pre-categorical store. Subjects were divided into high and low verbal ability, and were presented with word lists containing words from three semantic categories. Presentation was either pseudo-random or in semantic blocks. A comparison of the pseudo-random and block presentation methods indicated that high verbal ability subjects did better. An analysis of variance showed, however, an interaction between verbal ability and recall stage, and a post hoc analysis indicated that this was the result of a larger difference in clustering score for high verbal subjects in the first stage of recall. The findings tend to support the notion that high verbal ability leads to a greater "echobox" store where more items can be held verbatim and thus retrieved more readily. (NG)

Individual Differences in Information Processing: Verbal Ability and Memory Encoding Processes

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After decades of neglect, mentally handicapped people are at last receiving a greater measure of public and professional concern. While there have been notable improvements in the care and education of the mentally handicapped, a great deal remains to be done. It is not enough to proclaim that we wish to help each person to develop to the best of his ability and to realize his full potential if, as has already happened recently, we are no longer quite sure that we know how to define either ability or potential.

Much of the difficulty we seem to have in defining ability stems from the fact that despite their widespread use, generally-known intelligence tests are highly empirical, atheoretical devices. This situation stems from the greater emphasis traditionally placed on the predictive validity of intelligence tests than on the elaboration of intelligence as a theoretical construct. The research that I wish to discuss today represents a first attempt to close the gap between the psychometricians and the theoreticians by introducing the notion of individual differences into the currently popular information processing model of cognition.

There are, of course, many different information processing models but most share certain characteristics in common. They almost all posit two broad dimensions along which intellectual functioning may be described. The first dimension, memory structure, refers to processes that are thought to be "wired-in." These remain more or less constant across tasks and situations. The second dimension, control processes, refers to cognitive processes that vary across situations and, probably, from person to person. Often, cognitive processes are spoken of in terms borrowed from the information sciences. I will resist the temptation to draw any flow charts since what I wish to concentrate on in the remaining time alloted is but one issue--the relationship between verbal ability and memory for order. The ability to retain information about the order of events is assumed in practically all psycholinguistic models of speech perception. Since individuals who score high on psychometric tests presumably display a facility for using language, it is a reasonable hypothesis that, among their many talents, they are better able to retain order information that those who score low on such tests.

Hunt and his colleagues (Hunt, Frost and Lunneborg, 1973; Hunt, Lunneborg & Lewis, 1975) have conducted several experiments designed to investigate the relationship between verbal ability and sensitivity to order. These studies were concerned with such disparite phenomena as semantic category clustering, release from proactive inhibition, memory for the presentation of alphabetic characters, and the speed of information processing. Taken as a whole, these experiments indicate clear differences between high

and low verbals. They do not, I think, unequivocally, indicate that this difference is in sensitivity to order. In a recent paper (Schwartz & Maney, 1975) I reported that high verbals display a remarkably better memory for the sensory aspects of recently presented verbal material than lows. Their superiority was thought due to the high verbals greater reliance on (and more efficient use of) a pre-categorical, modality specific sensory memory store. In the case of material presented auditorally, for example, a superior "echobox" memory will often lead to what appears to be a greater sensitivity to order. It is the present hypothesis, however, that this effect is limited to only the most recently presented items and that beyond these items, high and low verbals do not differ in their respective memories for order. Since the experiments reported by Hunt and his coworkers do not permit us to distinguish between memory for order as a byproduct of the recency effect and order information that has been encoded and may be retrieved from long term memory, several additional experiments were conducted in our laboratory. The first, and the one I wish to describe here was concerned with semantic category clustering.

Hunt and his coworkers found both high and low verbals recall semantically related materials in clusters when the original list presentation is blocked. That is, when all of the items within a semantic category are presented continguously. When the original list presentation is random, the high verbals show marked drop in clustering while the low verbals do not. According to the authors, these results are due to the high verbals tendency to recall items in their original order of presentation. Unfortunately, the support for this contention was, as the authors admitted, rather weak.

There was, for example, no significant difference between high and low verbals in their respective tendencies to recall words in their original order even though some high verbal subjects reported that this was, indeed, their strategy. Nevertheless, since verbal ability groups did differ in their respective amounts of clustering--when the blocked and unclocked conditions are compared--this experiment is worthy of further scrutiny. It is the present contention that these findings may be explained by hypothesizing a greater "recency" effect for high than for low verbals. Thus, although both groups recall first the last several list items present in the "echobox" store, the number of these items is greater for high then for low verbals. Both groups then recall the remaining items using clustering as a helpful organizational aid. When presentation is blocked, both groups give similar clustering scores because verbatim recall, in such cases yields high clustering score. When the presentation order is unblocked, both groups show a decrease in clustering because both are recalling the last few items in a verbatim fashion. This decrease is greater for the high verbals because their pre-categorical, sensory store holds a greater number of words (which are recalled in a verbatim fashion) than that of lows. We would expect to find if this hypothesis is correct, that clustering scores calculated after omitting the items retrieved from the pre-categorical store do not differentiate high from low verbals even when the original list presentation was unblocked.

In order to test this hypothesis, a subject population of male and female students and non-students were administered the Lorge-Thorndike Intelligence Scale. Fifteen subjects were classified as high and 15 as low verbal by dividing the entire score distribution along the median. Two lists were constructed so that each contained

10 words from each of three semantic categories. The words were chosen from among moderate frequency category members of the lists compiled by Battig and Montague (1969). Each list was presented in two conditions: a pseudorandom order (words from the various categories were mixed so that only twice did two words from the same category follow one another) and in a blocked order (all words within a single category were presented contiguously). The words were presented via slides shown for 2.5 seconds with a 1-second intertrial interval. At the conclusion of a list, the subjects were given two minutes to write as many words as they could recall on an answer sheet provided for this purpose. Each list was presented to each subject four times--twice in the blocked and twice in the pseudorandom order--for a total of eight list presentations. The sequency of list presentations was balanced as to list order (blocked or pseudorandom). Whether list one of two was presented first was determined by the toss of a coin.

In order to establish the comparability of the present results with those reported by Hunt, free recall was scored first for the total number correct. The mean number of words recalled by the low verbals was 22.14 and 20.10 in the blocked and pseudorandom conditions respectively. The corresponding means for high verbals were 23.89 and 21.19. These means were not significantly different and are virtually identical to those reported in earlier studies.

Recall was scored for clustering according to Bousfield's (1953) ratio of repetition (RR) formula which has been shown to be independent of the number of words recalled (Frender & Doubilet, (1974). The RR score was calculated four times for each list recalled. Once for the total recall and once for each of three recall

stages. These stages corresponded to each successive third of a subject's free recall output. The mean RR scores are reported in Table 1.

Insert Table 1 About here

Looking at the clustering scores for the entire recall, it seems quite apparent that both high and low verbals showed quite high rates of clustering when list presentation was blocked. While both verbal ability groups showed a decrease in clustering when the lists were presented in a pseudorandom order, this decrease was much higher for high than for low verbals (the t for the difference scores was 2.93, d.f.=28, $p<.01$). This result is of course, identical to the one reported earlier by Hunt. If, however, we look at the RR scores broken down into stages of recall, it is obvious that for both verbal ability groups, the difference in clustering when blocked presentation is compared with pseudorandom is largely confined to the first stage of recall. An analysis of variance performed on the difference scores obtained by subtracting the RR scores on trials in which original list presentation was pseudorandom from those in which it was blocked revealed an interaction between verbal ability and recall stage ($F = 6.05$, df=1,28, $p<.01$). A post-hoc analysis (Winer, 1962) indicated that this interaction was the result of a larger difference in clustering score for high verbal subjects in stage one of recall.

In order to determine whether this drop in clustering score was indeed due to an increase in verbatim recall, RR scores were computed for stage one once again. This time, however, recall was scored for adherence to presentation order. That is we were inter-

ested in determining how many times words following one another during presentation also followed one another in recall. These scores were .68 and .41 for high and low verbals respectively--a significant difference (t= 2.89, df=28, p<.01).

Finally, in order to be certain that the words recalled in stage one were, in fact, the most recently presented items, a count was made of the number of items in stage one that were among the last ten presented. For high verbals, a mean of 79% of their stage one recall was made up of words from among the last ten presented. For low verbals the corresponding number was 53%. Once again, this difference was significant (t=3.12, df=28, p<.01).

The results of this experiment are in most respects identical to those reported by Hunt and his colleagues. They indicate that, when a list of words is presented in a pseudorandom order, low verbals tend to cluster semantically related items together more than highs. This difference was shown, however, to be confined to only the first stage of recall in which high verbals tend to recall the last eight or so words presented in a verbatim order whereas the low verbals recall only the last five words in a verbatim order. Beyond the last words presented both verbal ability groups showed the same pattern of semantic clustering. These findings provide no support for the notion that high verbals encode more information about the order of input events than low verbals. They only show that high verbals have a greater tendency to retrieve the last few items presented in a verbatim order. Subsequent findings have served to support this first study.

The importance of this finding for theories of individual difference in information processing is quite clear. High verbals

tend to retain more information in a "echobox" store which gives them more data to encode and therefore to retain. Direct measures of information processing, then, would have to include some measure of the "recency" effect, and speed of transfer of data from the sendory store to long term memory as this seems to be one locus of high verbals' advantage.

References

Bousfield, W.A. The occurance of clustering in the recall of randomly arranged associates. Journal of General Psychology, 1953, 49, 229-290.

Frender, R. & Doubilet, P. More on measures of category clustering in free recall--although probably not the last word. Psychological Bulletin, 1974, 81, 64-66.

Hunt, E.B., Frost, N., & Lunneborg, C.L. Individual differences in cognition: A new approach to intelligence. In G. Bower (Ed.), Advances in Learning and Motivation (vol. 7). New York: Academic Press, 1973.

Hunt, E.B., Lunneborg, C.L., Lewis, J. What does it mean to be high verbal? Cognitive Psychology, 1975, 7, 194-225.

Schwartz, S. & Maney, J. Individual differences in cognitive processes: Some relationships between verbal ability and memory for prose. Paper presented at the annual meeting of the Midwestern Psychological Association Chicago, May, 1975.

Winer, B.J. Statistical principals in experimental design. New York: McGraw Hill, 1962.

TABLE 1

MEAN RECALL AND CLUSTERING SCORES FOR THE TWO VERBAL ABILITY GROUPS

GROUP	Clustering Scores			
	First Stage	Second Stage	Third Stage	Total
HIGH VERBAL				
Blocked	.93	.94	.91	.94
Pseudorandom	.29	.81	.79	.52
Difference	(.64)	(.13)	(.12)	(.42)
LOW VERBAL				
Blocked	.91	.89	.92	.91
Pseudorandom	.71	.82	.84	.77
Difference	(.20)	(.07)	(.08)	(.11)